

33. Contributions to the Anatomy and Systematic Arrangement of the Cestoidea. By FRANK E. BEDDARD, M.A., D.Sc., F.R.S., F.Z.S., Prosector to the Society.

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(Text-figures 1-6.)

XVII. ON *TENIA TAURICOLLIS* OF CHAPMAN AND ON THE GENUS *CHAPMANIA*.

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I obtained, on June 30th, 1914, a large number of examples of Cestodes from an American Rhea (*Rhea americana*) which died in the Society's Gardens on the previous day. All these worms were found in the right cæcum, and none of them in the small intestine. As is known, the cæcum is very rarely found to be inhabited by Cestode parasites, though there are cases on record*.

From this bird three species of Cestodes have been described. Of these three, *Cittotenia rheæ* may be set aside at once as having nothing in common with the species which forms the subject of the present remarks. This latter species is identical with either *Tenia tauricollis* of Chapman or *Tenia struthionis* Houttuyn among those which have been found in Rhea, or is another species altogether. *Tenia tauricollis* has been placed in a genus *Chapmania* (which is not widely different from *Idiogenes*), while *Tenia struthionis* is now assigned to *Davainea*. In spite of this generic separation, which depends upon the not at all full description of *Davainea struthionis* by Parona † and von Linstow ‡, I am by no means certain that they are not actually identical at least generically.

Davainea struthionis, though found in the Ostrich, is stated by Fuhrmann § to occur also in *Rhea americana*; but the statement of Fuhrmann is not advanced with absolute positiveness; and it is only a statement in that no characters of *Davainea struthionis* are given by him to confirm the identification. The fullest account of the structure of *Davainea struthionis* is that of v. Linstow. Parona's notes give no anatomical detail to speak of. It is probably therefore to the former paper that the responsibility for including this species in the genus *Davainea* by all subsequent

* See Bronn's 'Thier-Reich,' Bd. iv. Abth. 1 B, p. 1625.

† Ann. Mus. Civ. Genova (2 a) ii. 1885, p. 425.

‡ Arch. f. mikr. Anat. xlii. 1893, p. 447.

§ "Die Cestoden der Vögel," Zool. Jahrb. Suppl.-Bd. x. 1908, pp. 6 and 19.

authors is to be referred. Von Linstow himself assigns the worm to the genus *Davainea* by reason of the form of the hooks. That character, however, is now known in other genera—though all of them of the family Davaineidae.

Those who have written subsequently upon this species, *Davainea struthionis*, have probably accepted its generic rank rather from the remarks of Max Braun than from the facts detailed in v. Linstow's memoir. The former has pointed out in Bronn's 'Thier-Reich' * that the alleged ovary of v. Linstow, consisting of a number of separate spherical masses, is not indeed the ovary, but an instance—largely met with in the genus *Davainea*—of the "Parenchymkapseln" of German writers, in which the ripe ova are massed after the disappearance of the uterus (when that sac is clearly developed in the genus, which would seem to be not always). Apart from this interpretation of the "ovary" of v. Linstow and the nature and distribution of the setæ according to v. Linstow, there is nothing in the description of that writer which would justify the reference of "*Tenia struthionis*" to the genus *Davainea*. It will be observed that there is therefore no reason to distinguish this worm from *Chapmania tauricollis*, at any rate so far. The detached masses of ripe ova correspond with what I shall shortly describe in that species, where the uterus is more or less broken up into partly separate cavities containing eggs. The general form and size of the species which has been termed *Davainea struthionis*, as figured by Parona †, is precisely what I have found to characterise the worm from *Rhea americana*, which in other ways agrees positively with the descriptions extant of *Chapmania tauricollis*. We have, however, to assume, if this identification be correct, that v. Linstow has missed the paruterine organ. This is, however, not evident in immature proglottids. I can hardly claim to have proved specific identity; but I believe it would be difficult on the facts known to deny generic identity between these two species.

In the meantime, however, I identify the species described in the present paper with that described by Chapman, Fuhrmann, and others as *Tenia*, *Davainea*, or *Chapmania tauricollis*. It reaches a length of fourteen inches or so and has thus much the dimensions given by Chapman ‡. It is held that *Tenia argentina* of Zschokke § is the same species. If so, there would appear to be a discrepancy in that the measurement of length given by Zschokke is 8-9 cm. I am able, however, to clear up this difficulty. The majority of my specimens agreed with Chapman's in their dimensions; but in a few the length was not greater than 8 cm. or so.

The anterior segments of the body form a long tract, which is very slender and widens out more or less suddenly to the wider

* Bd. vi. pt. ii. p. 1446.

† Ann. Mus. Civ. Genova (2a), ii. 1885.

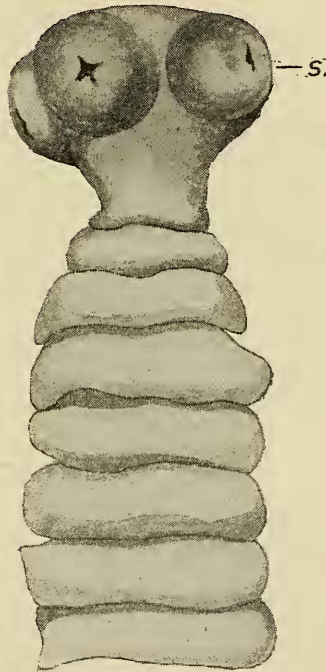
‡ Proc. Acad. Sci. Philadelphia, 1876, p. 14.

§ Centrabl. f. Bakt. u. Paras. iii. 1888, p. 2.

(3-4½ mm.) posterior region. The most posterior segments are hardly, if at all, longer than wide. There is no neck.

The figure given by Chapman* of the scolex and anterior segments is quite in accord with the view that the species described by himself is that which I regard here as "*Tenia tauricollis*." He does not, however, figure or make any reference to hooks upon the rostellum (or, for the matter of that, elsewhere). Monticelli†, however, in his fuller description, found

Text-figure 1.



Scolex and anterior segments of *Chapmania tauricollis*.

s. Sucker.

the hooks, which he described as "minutissimi uncini." It would not be difficult to miss these hooks; I find from a note made by myself upon the living worm that no hooks were seen. I have, however, closely examined the scolices of two preserved examples—the only scolices which I possess—and find traces of the hooks in one individual only. The other specimen was

* Proc. Acad. Sci. Philadelphia, 1876, p. 14.

† Nat. Sicil. xiii. 1892-3, p. 208.

devoid of hooks. The one which showed them only possessed a few, which needed a high-power lens and good illumination to show them up. It seems to me that they may easily be shed. I am quite unable to make any statement as to the shape of these hooks. They appeared to be little more than acicular in form, like the hooks of the suckers in some *Davainea*. The feebleness of the rostellar hooks seems to me to be related to the little marked character of the rostellum in this and other forms. I may remark that there is no reason to believe that the present species has any hooks upon the suckers*. I shall return later to the questions of systematic arrangement which depend upon the presence of hooks in connection with the genera *Zschokkeella* and *Inermicapsifer* and some others.

In spite of the fact that Chapman described the genital pores of his species as alternating irregularly, the genus *Chapmania* has been defined by some subsequent writers as unilateral, at any rate in the particular species *Chapmania tauricollis* †. Chapman himself remarked that five pores might follow consecutively upon the same side of the body. I have seen ten segments in series with the genital pores all upon the same side. It is therefore obvious where the error may have crept in. The genital pores lie at about the middle of the lateral border.

I shall now deal with a few points in the internal structure of this Cestode.

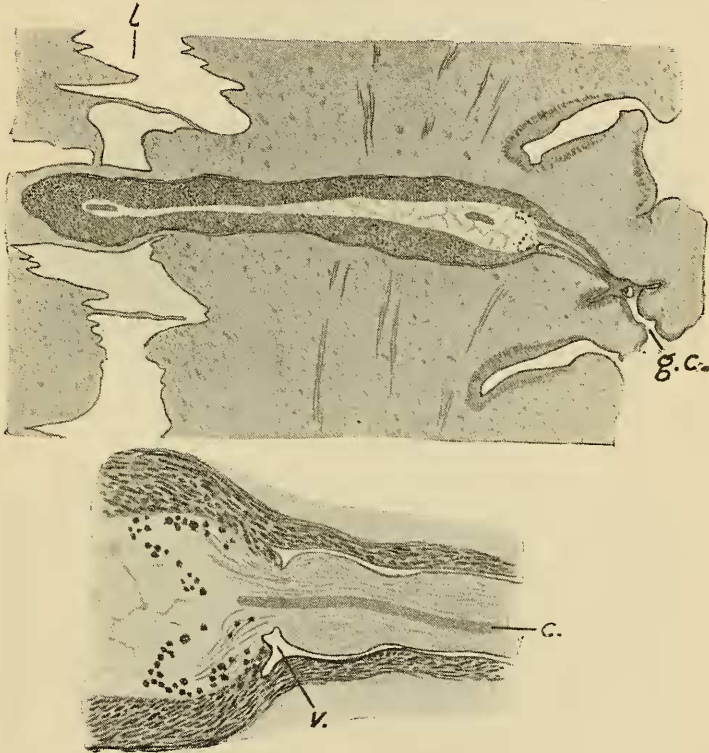
The *cirrus-sac* does not seem to me to have been fully described by Fuhrmann. The *cloaca genitalis*, as he has pointed out, is deep and expands within the cortex in a funnel-shaped way. Into the middle of this funnel opens the *cirrus-sac*, and through it projects often the protruded *cirrus*. The *cirrus-sac* appears to consist of two distinct regions, or it may be, as I shall point out later, that the *cloaca genitalis* consists of two distinct regions. In any case a bottle-shaped sac opens into what is unquestionably the *cloaca genitalis*, the neck of which "bottle" is much shorter than the rest. This relatively narrow tube has muscular walls quite continuous with those of the rest of the *cirrus-sac*, and in it lies the *cirrus*, which nearly fills up its lumen in *cirrus-sacs*, which are in an average state of protrusion of the *cirrus*. The rest of the *cirrus-sac* extends into the body of the worm some way inwards of the lateral water-vascular tube and ends in a retractor muscle, as has been described by Fuhrmann. The flask part of the *cirrus-sac* is divided from its narrow neck by a sphincter-muscle, which forms a collar within the lumen of the sac, and to the inside of this a fan-shaped bunch of muscular fibres, provided with nuclei at their internal ends, further blocks the lumen and

* Fuhrmann, however (Rev. Suisse Zool. iv. 1896, p. 111), not only refers to hooks upon the rostellum, but speaks of having seen the evidence of hooks upon one sucker. The definitions of the genus *Chapmania* given by Fuhrmann and Ransom do not use hooks upon the suckers as a character of that genus.

† I. e., Ransom, Proc. U.S. Nat. Mus. vol. xl. 1911, p. 637. Also used as a character of "*Tenia argentina*" (believed to be synonymous by Zschokke, Centralb. Bakt. u. Paras. iii. 1888, p. 1).

serves, as I imagine, as a retractor of the cirrus. The vagina opens at the junction of the neck and the flask-shaped region, a fact which rather tends to prove that the neck region really belongs to the cloaca genitalis, unless it be remembered that the male and female genitalia have really a common origin and are parts of a single system. The various facts to which attention has been called are illustrated in the accompanying figure of the cirrus-sac and its external orifice (text-fig. 2).

Text-figure 2.



Horizontal section through cirrus-sac.

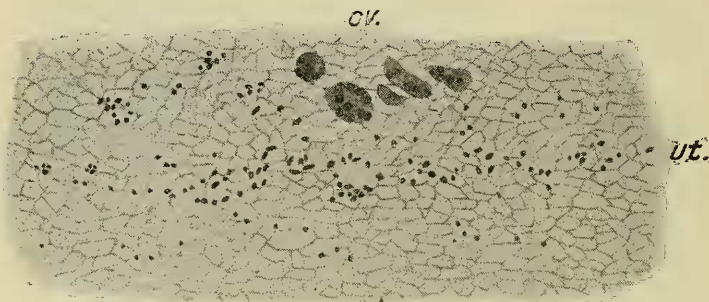
In the lower figure the junction of the two parts of the cirrus-sac is shown more highly magnified.

g.c. Genital cloaca. *c.* Cirrus. *v.* Muscular valve-fold separating the narrow part of the cirrus-sac from the wider region. *L.* Water-vascular tube.

The earliest appearance of the *uterus* is represented in text-fig. 3. It is there seen to consist of a modified tract of medullary tissue lying anteriorly to the male and female gonads, at about

the middle of the proglottid and on a level with the cirrus-sac. It forms a nearly straight line about the middle of the proglottid, wider in the middle of its length and tapering off to the side of the proglottid remote from the cirrus-sac, in which direction it does not reach the lateral water-vascular tube. At the other end the growing uterus is limited by the cirrus-sac and the coil of the vas deferens. In the lateral, most immature part of the uterus that organ appears to be formed by only a very slight modification of the medullary tissue. There is simply an increase in the number of the nuclei, which are thus closer together and become more conspicuous.

Text-figure 3.



Horizontal section through immature proglottid, to illustrate earliest appearance of uterus (*ut.*). *ov.* Ovary.

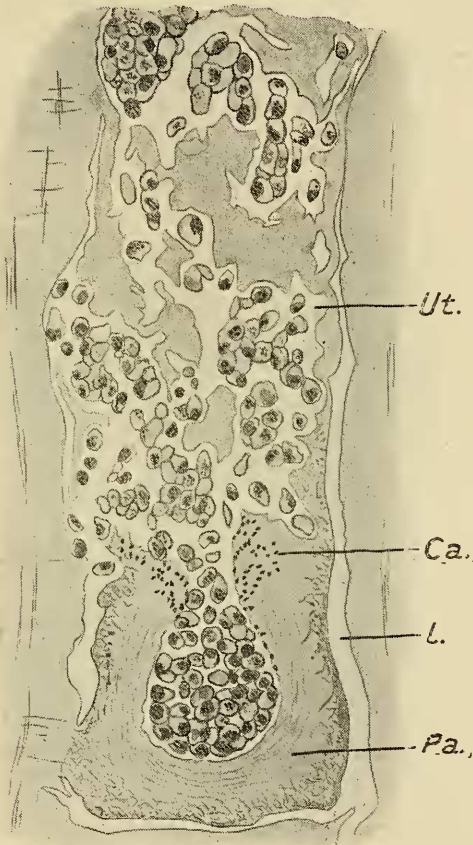
In the more central parts of the uterus at this stage, which, as already said, is wider, the nuclei are more abundant, both actually and relatively. Between them cavities appear, all of them small but of varying sizes; the dimensions of some coincide very closely with the meshwork of the general medullary parenchyma. The nuclei, at least in many cases, are arranged round these spaces in a regular fashion and thus constitute a lining epithelium to these uterine cavities. The several cavities are separate from each other in this early formed uterus. Fuhrmann* has observed the same mode of origin of the uterus of *Chapmania tauricollis*, and remarks: "Anfangs erscheint der Uterus gekammert."

In later stages there is a confluence of these cavities, and in the fully developed uterus such as is represented in text-fig. 4, the uterus appears to consist of a larger central cavity which is prolonged in all directions through the medullary parenchyma into outgrowths. I am disposed to think that these latter intercommunicate and form a network. In horizontal sections near to the dorsal and ventral surfaces of the uterus the retiform appearance is very strikingly manifested. In transverse sections

* Rev. Suisse Zool. iv. 1896, p. 121.

through the mature uterus the appearance of a number of detached cavities containing ripe eggs is often presented. It is, perhaps, this condition which has led to the explanation by v. Linstow* of the clusters of ripe eggs seen in "*Tenia struthionis*."

Text-figure 4.



Horizontal section through mature uterus, showing opening into paruterine organ.

Ca. Mass of calcareous bodies at orifice of uterus. *L.* Lateral water-vascular tube.
Pa. Paruterine organ. *Ut.* Uterus.

The *paruterine organ* of this species has been figured by

* Arch. mikr. Anat. xlii. 1893, pl. xxviii. fig. 14.

Zschokke* in the course of his description of "*Taenia argentina*," but mistaken by him for a testis, with which identification Monticelli associated himself †. Fuhrmann ‡ recognised the true nature of this body, which was certainly puzzling at a time when the paruterine organ, now known in so many Cestodes, was hardly or not at all understood. Zschokke has rightly called attention to the mass of calcareous bodies lying behind the anteriorly placed paruterine organ. The first beginnings of this organ are not plain to me, so little differentiated are at first its tissues from that of the medullary parenchyma of which it is a part. But I feel safe in saying that it does not put in an appearance for some time after the uterus has commenced to develop. I mention this matter as being of importance, since in the species *Rhabdometra cylindrica* the paruterine organ appears before the uterus. There is thus in the present species no obvious connection in development between the two organs. The paruterine organ in a fairly early stage of development lies, as has been stated, anteriorly in the segment and quite close to the anterior edge of the uterus, which is behind it. This surface of the paruterine organ is capped by a rather dense mass of calcareous bodies. The calcareous bodies are not, however, confined to this region of the paruterine organ, or rather to the outside of it; they also occur scattered throughout its substance, but not in such great numbers and not, where present, so closely pressed together. The general outline of the paruterine organ in these not fully mature segments is shown in horizontal sections to be somewhat conical, but with a rather convex base, the latter being anterior in position.

It is, furthermore, to be noted that the paruterine organ is very closely related to the uterus, which lies behind it. The mass of calcareous bodies and the margin of the mass forming the immature paruterine organ are divided by nothing from the uterine cavity. The uterus, that is to say, has no anterior wall save that which is furnished by the paruterine organ. There is thus a distinct relationship between the uterus and the paruterine organ. At this period in its development the paruterine body is solid throughout; there is no trace of a central cavity. In proglottids at the end of the body, which are rather longer than broad and apparently quite mature, the paruterine body has the appearance which is represented in the accompanying figure (text-fig. 4). This is a representation of a horizontal section showing the paruterine body rather oblong in form with rounded angles. It is sharply marked off from the parenchyma of its proglottid laterally. Posteriorly it is not marked off from the cavity of the uterus, that is to say the uterus has no wall of its own dividing it from the paruterine organ. The two structures indeed seem to be mutually differentiated parts of one structure.

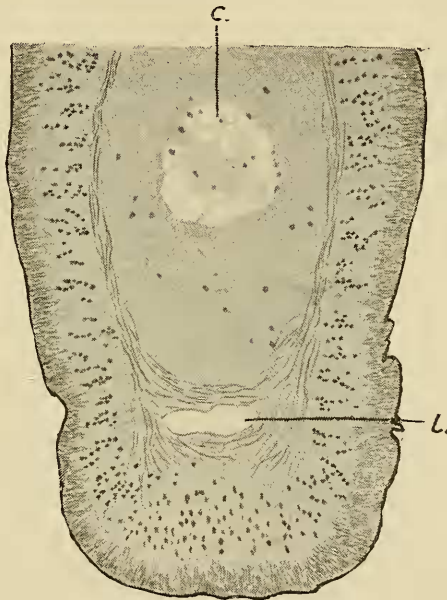
* Centralb. f. Bakt. u. Parasit. iii. 1888, p. 1.

† Nat. Sicil. xii. 1892-3, p. 208.

‡ Rev. Suisse Zool. iv. 1896, p. 122.

The paruterine part is about one-third of the total length of the egg-holding receptacle. The walls of the paruterine body are thick, and the fibrous-looking tissue has the strands running along the greater length of the body. Externally it is plainly marked off from the tissue of the medullary part of the proglottid. The mass of calcareous bodies is as plain here as in the younger paruterine organ; but it has got a more definite coherence of its own; the corpuscles are imbedded in a tissue which forms a cap to the paruterine organ and protrudes into the cavity of the uterus behind. The suggestion is that of a valve which, however, hinders the flow of ova into the paruterine organ rather than the converse, which is what would be expected.

Text-figure 5.



Transverse section through mature proglottid, showing paruterine organ.

c. Central cavity of paruterine organ. l. Lateral water-vascular tube.

The close relationship of the paruterine organ to the uterus is reminiscent of the conditions which obtain in the not nearly allied genus *Mesocestoides*. In this Cestode, which has been investigated by Hamann *, Fuhrmann †, and some others, the uterus is divided into two regions which form a continuous tube. Posteriorly the uterus acquires thick fibro-spongy walls and serves

* Zeitschr. f. wiss. Zool. 1885.

† Swedish Exped. Egypt, pt. iii.

as the ultimate receptacle of the ripe eggs, being closed to form a spherical capsule. It is this region which suggests the paruterine organ of *Chapmania*, a comparison which Fuhrmann seems, in the memoir quoted, to hold as possible, though Hamann compares this swollen and metamorphosed part of the uterus with a shell-gland (a comparison which seems to be negatived by the discovery of an ordinary shell-gland by Zschokke and others). In no genus, however, is there quite so intimate a connection between the uterus and what is certainly a paruterine organ as in *Chapmania*. It is quite likely that *Mesocestoides* has preserved the original relationship between these parts of the reproductive system.

The access, therefore, of the ripe eggs in the uterus to the paruterine is thus assured; and the drawing to which I have referred (text-fig. 4) shows this movement in progress. The eggs occupy the central hollow region of the paruterine organ, and are to be seen in transit in various parts of the same and of the uterus. I have observed eggs entangled, as it were, in the lax tissue forming the plug of calcareous bodies*. There is no doubt but that here the transference of ova to the paruterine from the uterus is quite direct. They could hardly reach it by another route, in view of the free continuity of the two sacs.

Nevertheless, another view has been advanced by Fuhrmann †.

In his important résumé of the genera of Cestodes found in birds, this author remarks in the definition of the genus *Chapmania*—“Die Eier gelangen in einen stark verzweigten Uterus und von da wie bei *Davainea* in Parenchymkapseln, worauf sie in abgelösten Gliedern in ein am Vorderrand gelegenes breites, grosses Paruterinorgan gepresst werden, das eine Kapsel um sie bildet.” This definition is accepted by Ransom, who practically translates it in his general survey ‡ of the Cyclophyllidea. In a later and fuller table of distinctions of the genera of Davaineidæ § this is altered. In the latter, Ransom says (as part of his definition of the genus *Chapmania*), “Eggs pass anteriorly into a paruterine organ from the uterus either directly or after the disappearance of the uterine wall and the envelopment of the eggs in individual parenchymatous capsules.” This alternative statement as to the fate of the ova is apparently due to an earlier definition by Fuhrmann of the genus *Chapmania* ||, which runs (so far as concerns the matter under discussion) as follows—“Die Eier, statt im Parenchym zu

* It may be pointed out that, in his figure of *Chapmania longicirrhosa* (later regarded as identical with *Idiogenes flagellum*), Fuhrmann (Centralb. f. Bakt. u. Parasit. Bd. 41, p. 81, fig. 3) represents a mass of calcareous bodies such as occurs in *Chapmania tauricollis*, but upon the opposite side of the paruterine organ, *i. e.* upon its anterior face. If this be not an error there is perhaps here an additional point of distinction between the two genera.

† Zool. Jahrb. Suppl.-Bd. x.

‡ Bull. U.S. Nat. Mus. no. 69, 1909.

§ “A New Cestode from an African Bustard,” Proc. U.S. Nat. Mus. vol. xl. p. 646, 1911.

|| Centralb. f. Bakt. u. Parasit. Bd. 41, 1906, p. 83. This memoir, however, is not quoted by Ransom, which is merely an oversight, as he refers to it in a footnote enumerating the synonyms of *Idiogenes flagellum*.

zerstreuen, in ganz reifen losgelösten Proglottiden in einem parenchymatösen Paruterinorgan, das zu einer Uteruskapsel wird, vereinigen." I believe, however, that this definition was made to include the species described in that memoir as *Chapmania longicirrhosa*, a species which Fuhrmann later * transferred to the genus *Idiogenes*, and to the species *I. flagellum*.

I have been quite unable to find a trace of anything like the "Parenchymkapseln" of *Davainea* or any other genus in which such structures exist. Nor do I think that it would be easy to miss such bodies were they, at any rate, so conspicuous as in the genera which are known to possess them (e. g., *Inermicapsifer*, etc.). My figure is, as I think, decisive as to the direct entry of the ripe ova into the paruterine organ; in no other possible way can the facts observed, and there represented, be explained. I can only suggest that the irregular form of the uterus in ripe proglottids, as I describe it later, may be responsible for the statement that the eggs are separately envolved in parenchymatous capsules before being pushed into the paruterine organ. For in many sections ova may be seen to lie apparently in closely fitting capsules, these being in reality the expression of the ramifying branches of the uterus. Or it may be that both methods occur in this species, or finally, there is the possibility, which I do not consider to be very great, that the worm which I deal with in the present communication is not *Chapmania tauricollis* but a new form.

The last word about the paruterine organ of this Cestode is contained in Fuhrmann's account of *Chapmania tapica* †. Here that author states that "Bei *Chapmania* (auch bei *Chap. tauricollis*) geschieht dieser Uebertritt der Eier erst in abgelösten Gliedern und ist deshalb von andern Autoren noch nie beobachtet worden." It is clear, from my own observations, that the eggs reach the paruterine organ at an earlier period. I think, however, that in my species, *Otiditenia eupodotidis*, plainly belonging to this subfamily, this late transference does occur.

*Systematic Position of Chapmania tauricollis and validity
of genus Chapmania.*

There is, of course, no need to argue the position of this tapeworm so far as concerns its family and subfamily position. It is clearly a member of the subfamily Idiogeninæ of the family Davaineidæ.

This subfamily contains three genera, viz., *Idiogenes*, *Chapmania*, *Sphyrnchotenia*, and very possibly my genus *Otiditenia* ‡. The most recent survey of the characters of the three former

* Zool. Jahrb. t. cit. p. 50.

† Swedish Exped. Egypt, pt. iii. p. 23.

‡ See P. Z. S. 1912, p. 194, and *ibid.* 1914, p. 879.

genera is by Ransom*, who distinguishes the three by the following salient characters—which I withdraw from his fuller diagnosis:—

Idiogenes.—Small worms with weak musculature. Genital pores unilateral (except in *I. otidis*). Suckers unarmed. Cirrus-sac large. Eggs pass directly into paruterine organ.

Chapmania.—Larger worms with strong musculature. Genital pores unilateral (in *C. tauricollis*). Suckers armed. Cirrus-sac not large. Eggs first developed in separate egg-capsules and then passed into paruterine organ.

Sphyrnchotenia.—Larger worms with strong musculature. Genital pores unilateral. Suckers unarmed. Cirrus-sac not large. Eggs pass directly into paruterine organ †. Many rows of hooks on rostellum.

We may leave aside *Sphyrnchotenia*, which is clearly a separate genus—not to be confounded with either *Idiogenes* or *Chapmania*. With regard to the two latter the differentiation deducible from the above characteristics is altered to some extent by the new facts recorded in the present communication. In the first place, the cirrus-pouch of *Chapmania* is not particularly small as is alleged by Ransom. I take it that the American helminthologist has been misled by the absence of any statement about the cirrus-sac of *Chapmania* in Fuhrmann's definition of the genus, while, on the contrary, *Idiogenes* is defined by a large sac. But the latter author, in his description of "*Davainea tauricollis*," remarks ‡ that the cirrus-sac reaches to the middle of the proglottid, a statement which I confirm from my own observations §. There is, therefore, here no difference between *Idiogenes* and *Chapmania*. I have discussed above, in detail, the statement that *Chapmania* differs from *Idiogenes* in the fact that the former genus shows a series of egg-capsules in which the ova are imbedded before their transference to the paruterine organ, and shown that there is no such difference between the genera. There remains, therefore, merely the difference of size and the stouter build of *Chapmania*, which is caused by the relatively and actually greater thickness of the longitudinal muscular layer of the body, to form a basis of distinction from its ally *Idiogenes*. It is not at all impossible to regard these facts as of generic value; but it must be remembered that

* Proc. U.S. Nat. Mus. vol. xl. 1911, p. 637.

† This is to be inferred, as the actual transference was not seen in any of its stages by Ransom.

‡ Rev. Suisse Zool. iv. 1896, p. 119.

§ But the exact point to which the cirrus-sac reaches is affected by the degree and direction of the contraction of the particular proglottid examined. It is possible that the generic distinction has been chiefly founded upon *Chapmania tapica*, where, according to Fuhrmann (Swedish Exped. Egypt, pt. iii. p. 23), the cirrus-sac hardly reaches the water vascular vessel.

variations in the longitudinal musculature are by no means always accompanied by other structures which imply undoubted generic difference among the Cestodes. It is possible, however, that a simple sac-like form of uterus characterises *Idiogenes**.

I should be, on the whole, disposed to define the genera of the subfamily Idiogeninæ as follows:—

Subfamily *IDIOPENINÆ*.

A single paruterine organ present in the ripe proglottid.

- | | | |
|--|---|--|
| A. Ten to twelve rows of hooks on the rostellum. | } | <p><i>SPHYRONCHOTENIA</i>.—Suckers unarmed. Genital pores unilateral. Longitudinal muscles thick. Dorsal water-vascular trunk absent in posterior proglottids. Testes numerous, extending far anteriorly. Uterus divided into chambers, larger than paruterine organ. Eggs transferred late to paruterine organ. Cirrus-sac small.</p> <p><i>OTIDITENIA</i>.—Suckers unarmed. Genital pores alternate. Longitudinal muscles thick. Dorsal water-vascular trunk present in posterior segments. Testes numerous, posterior. Uterus divided into chambers, extends dorsally into cortical layer, much smaller than paruterine organ. Eggs transferred late to paruterine organ. Cirrus-sac small.</p> |
| B. Two rows of hooks on the rostellum. | } | <p><i>CHAPMANIA</i>†.—Suckers armed. Genital pores alternate. Longitudinal muscles thick. Dorsal water-vascular vessel absent in posterior proglottid. Testes numerous, posterior. Uterus divided into chambers, which in mature uterus communicate and form a network, larger than paruterine organ. Eggs transferred early to paruterine organ. Cirrus-sac large.</p> <p><i>IDIOPENES</i>‡.—Suckers unarmed. Genital pores unilateral or alternate. Longitudinal muscles slight. Testes few, posterior. Uterus not divided into chambers, larger than paruterine organ. Cirrus-sac very large.</p> |

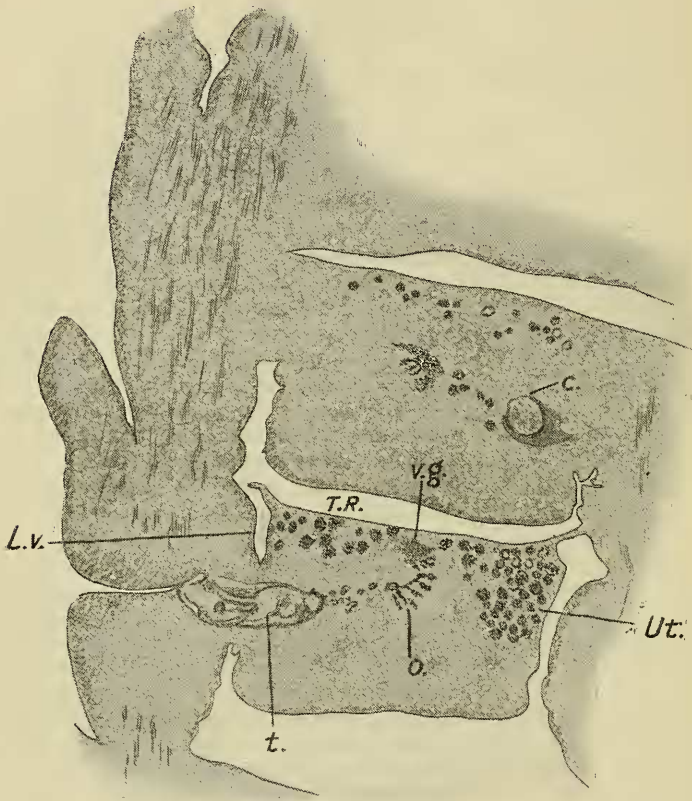
* See also footnote to p. 438 for another possible generic distinction.

† In view of the network which the sperm-duct forms and the tentacles upon the scolex, I exclude for the present *C. tapica* from the above genus.

‡ It will be noted that the feebly developed longitudinal muscular system, the small number of testes, and the simplicity of the uterus may be correlated with the small size of the species of this genus.

I may point out, in conclusion, that the subfamilies Idiogeninæ and Davaineinæ, have corresponding relations to Cestodes commonly referred to different families by reason of their lack

Text-figure 6.



Horizontal section through immature proglottids, showing position of gonads.

c. and *t.* Cirrus-sac. *l.v.* Lateral water-vascular tube. *o.* Ovary. *Ut.* Testes more thickly disposed on the side away from the pore. *T.R.* Transverse water-vessel. *v.g.* Vitelline gland.

of rostellar hooks. There is, for instance, a close resemblance between *Rhabdometra* and its allies and *Idiogenes*, which possesses a single paruterine organ, on the one hand, and between *Zschokkeella*

and *Inermicapsifer* and *Davainea*, with many "egg-capsules," on the other. In these instances the loss of the rostellar hooks would need the reference of *Davainea* to either *Zschokkeella* or *Inermicapsifer*, and of *Idiogenes* to *Rhabdometra* or one of its near allies. The relation is quite like that between *Teniarhyncha* (*sens. strict.*) and *Tenia*. In *Teniarhyncha*, a genus formed to include the hookless *Tenia saginata*, we have a typical *Tenia*, differing only by the character mentioned and the correspondingly reduced rostellum. It is, therefore, very important to ascertain positively the presence or absence of rostellar (and other) hooks in view of the above relations. This task is—my experience with *Chapmania* teaches me—not always easy. I have carefully re-examined the scolex of my species *Zschokkeella gambiana* in order to set doubts at rest. I am still unable to find hooks thereon, and cannot, therefore, alter my opinion of its systematic position.